

2 July 1963

PROPOSED AGENDA

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Brief history

TECHNICAL PRESENTATION

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Evaluation Programs  
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Declass Review by NGA.

### Interrupted Processing

In the type of photography of interest to us the required exposure may vary over such a wide range that only the most sophisticated system of exposure control would be adequate. Unfortunately, such systems cannot always be employed with the result that one may expect some portion of each mission will be incorrectly exposed. In order to get the most out of such material it would be ideal to use the classical "process by inspection" technique. This is virtually impossible with the physical format and materials we normally use.

Interrupted processing is one approach toward this goal and has been used successfully for several years in processing of original negative material. In the original concept the film was given a partial development, stopped, washed and dried. The dry film was then I.R. viewed and the required amount of second processing determined. Like parts were assembled as a unit and processed for the required time in the secondary developer after which they were fixed, washed and dried.

The next advance was to arrange the processor to combine the primary development, I.R. viewing and secondary development in a single machine. The required variation in secondary development time is achieved by dividing the secondary section of the processor into two parts. Each part of the secondary section is equipped to spray either water or developer. Thus, it is possible to give the film no secondary development (water in both parts) intermediate secondary development (developer in the first part, water in the second) or full secondary development (developer in both parts).

Since there is considerable film in the secondary section and since there must be a delay between the cutoff of one solution and the start

of the other (to avoid contamination), there are always several feet of film which are differentially processed. While this changeover area is tolerable for films where the changes in exposure are gradual, it would be intolerable in a film where exposures vary widely from frame-to-frame.

In order to achieve an interrupted process on a frame-by-frame basis, we chose to investigate the use of viscous developers which could be applied where and to the extent that they were required. The experience of those who had designed the Kodak Viscomat Processor indicated that such an approach was entirely sound if the particular chemistry required for our process could be worked out.

An applicator station was built solely to demonstrate that viscous developers could be applied to 70mm wide film on a discontinuous basis. This unit was used to study the edges produced at break off and pick-up of the coating bead and to establish first order criteria for setting operational standards. Results were so encouraging that as soon as support was provided the design and fabrication of a two level 70mm operational breadboard processor utilizing the coating station was undertaken at high priority.

The 70mm F x F Processor Breadboard (Figure 1) was designed for the following process.

1. Deep tank Primary Development
2. Deep tank Stop
3. Deep tank Rinse
4. I. R. Viewer and Frame Locator
5. Single Station Viscous Secondary Development
6. Hot water cutoff
7. Deep tank Fix
8. Deep tank Rinse
9. Wet windup

The following general specifications were also set up.

1. Time of the secondary development 1 min.
2. Machine speed 3 ft/min.
3. Hopper control to be operated from a magnetic tape running with the film.
4. Hopper control signals to be set into the tape manually at the I.R. Viewer station.
5. Film would be rinsed only - wound wet - then washed and dried on other equipment.

This breadboard was completed shortly after authorization and has provided a wealth of engineering and design information, proved the adequacy of the magnetic tape control, etc. It has been turned over to the Technical Assistance Group for use in establishing the proper chemistry. Subject to further confirmation and long run testing, it appears at this time that the chemistry for three level processing of one emulsion (SO-206) has been established and that a process for  $H_2O_4$  is feasible. Testing of  $H_2O_4$  will proceed as time permits.

As of mid June the following tests had been run with the results indicated.

1. Time - gamma series using D-19 for the first development. this series provided the requirement for the SO-206 standard primary curve.
2. Commercial Type I viscous developer was found to match the intermediate SO-206 standard curve. One minute of application of the viscous developer provided sufficient development.
3. The viscous interrupted development system was evaluated by processing SO-206 film which was exposed using a printing loop containing actual flight scenes, sensitometric stripe, and flashed density patches. The scenes which were two stops underexposed were greatly improved.
4. Engineering test data was provided which would provide information for the design of a complete prototype frame-by-frame processor. Density vs. time and gamma vs. time data were generated for processing times less than a minute to times longer than a minute. The effect of extended development time vs. multiple application with successive spray cut-off was also evaluated.

5. Experiments using various viscous developers were tried. Commercial developer No. 454 is unsatisfactory - too active at 70°F. Thickened MP-G-105-D is also unsatisfactory. Thickened MP-B-111 provides an acceptable full and intermediate process curve for SO-206.
6. A series of dip tests and frame-by-frame processing tests were made in an attempt to determine if dip test data could be directly applied to frame-by-frame processing. These tests indicated that the direction of change can be determined; however, the magnitude of the change cannot be determined.
7. Initial work in establish 1404 film standards has started. Results to date look promising.

We now propose the following fourfold program:

- I. Continue tests on the 70mm breadboard to confirm the results obtained thus far and extend this process to other types of films of possible interest as original negative material.
- II. The design and fabrication of a  $9\frac{1}{2}$ -inch breadboard viscous applicator station to study the problems associated specifically with the application of viscous materials to films up to  $9\frac{1}{2}$ -inch in width.

This unit will consist of a wetting tank, a single  $9\frac{1}{2}$ -inch applicator with adjustable path length, cutoff, fix, rinse and wet windup (Figure 2). A variable speed drive up to 25 ft/min. will be provided.

With this unit we will be able to check  $9\frac{1}{2}$ -inch hopper design and operation, orientation, problems associated with higher film transport rates, etc. It will also be useful in the future as a tool for checking other applications of viscous processing solutions, such as primary developers, fixes, etc, which may offer some advantages over conventional methods.

- III. The design and fabrication of a complete 70mm prototype three level frame-by-frame processor.

This will be a complete functional prototype (Figure 3) which will allow us to confirm the design concepts and provide for

operational processing of "Index" films. The unit will allow us to continue experimentation at an economical level.

The Design Specifications for the 70mm Prototype are:

1. Operating speed 5 ft/min.
  2. Primary Development - 5 min. maximum at 5 ft/min.
  3. Intermediate Development - Adjustable to 15-35% of full development.
  4. Full Development - 1 min. maximum at 5 ft/min.
  5. Automatic frame detector.
  6. Automatic I.R. density scanning and secondary processing level determination.
  7. Automatic input to the magnetic tape of the secondary processing level and frame location information.
  8. Magnetic tape hopper control.
  9. Mode 2 operation (common cutoff).
  10. Temperature control.
    - (a) Primary Development, Stop, Fix and Wash 70-90°F.
    - (b) Secondary Development 70-100°F.
  11. Air impingement drier.
  12. Take-up on standard 5-inch spools.
- IV. The design fabrication and installation of a fully operational frame-by-frame processor (Figure 4) capable of handling original negative material up to 9 $\frac{1}{2}$ -inches in width.

This processor will be similar to a Trenton with the I.R. Scanner and Secondary Developing sections replaced by new designs based on the experience derived from the 70mm prototype machine.

Approved For Release 2005/11/21 : CIA-RDP78B04770A001000040008-0

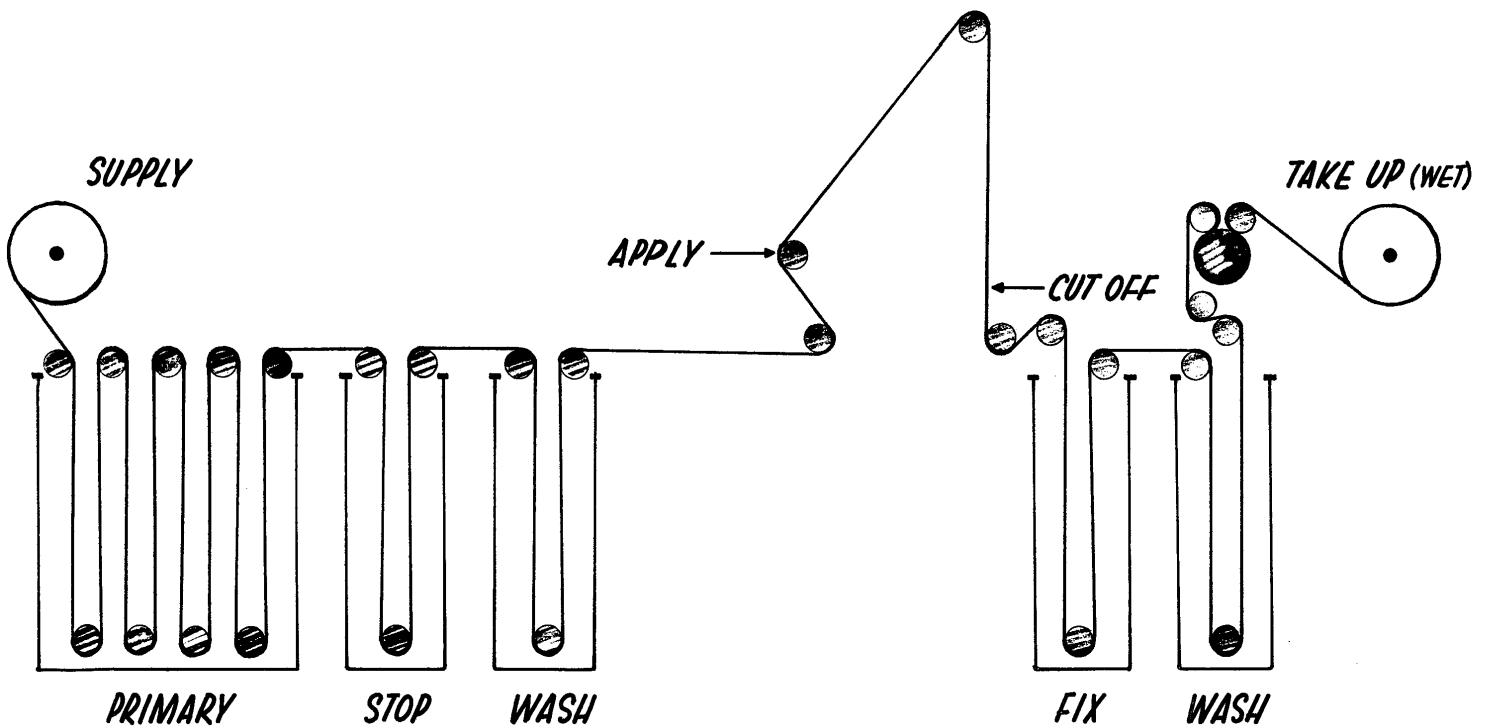
Frame-by-Frame Processor Program

1. 70mm Breadboard and Tests
2. 9 $\frac{1}{2}$ -inch Coating Station Breadboard
3. 70mm Processor Prototype
4. 9 $\frac{1}{2}$ -inch Processor

Approved For Release 2005/11/21 : CIA-RDP78B04770A001000040008-0

# **70 mm Fx F PROCESSOR (BREADBOARD)**

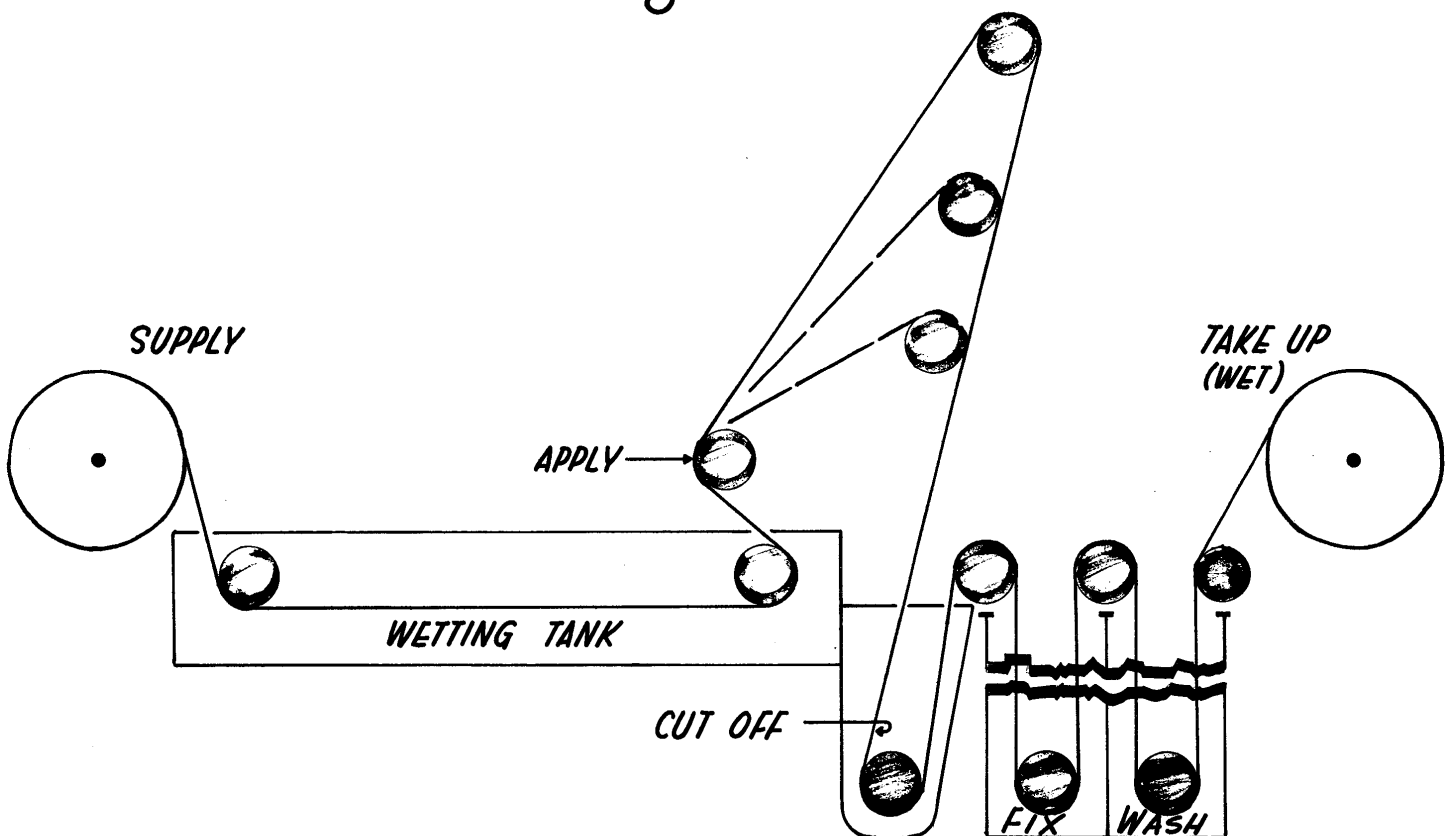
*Fig 1*



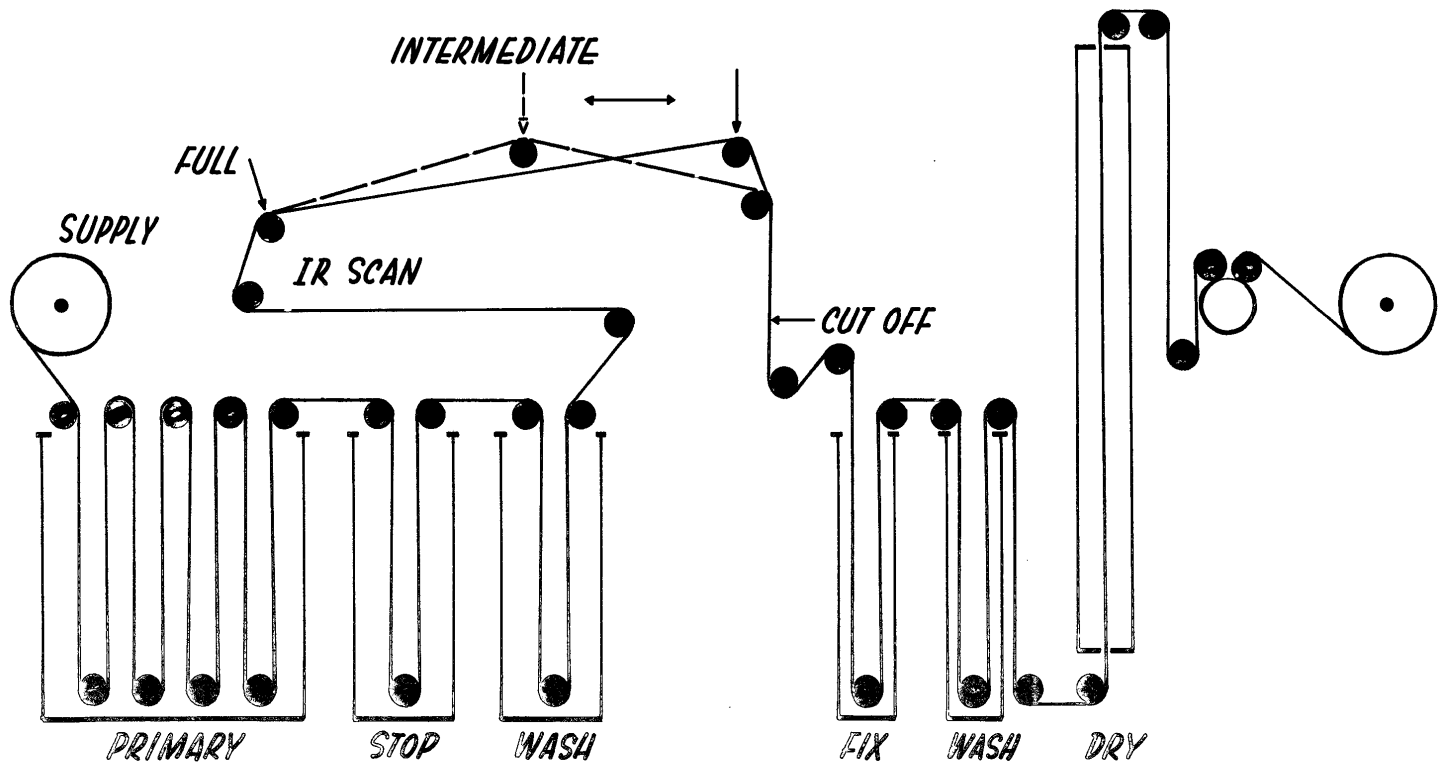


# $9\frac{1}{2}$ " COATING STATION (BREADBOARD)

Fig 2

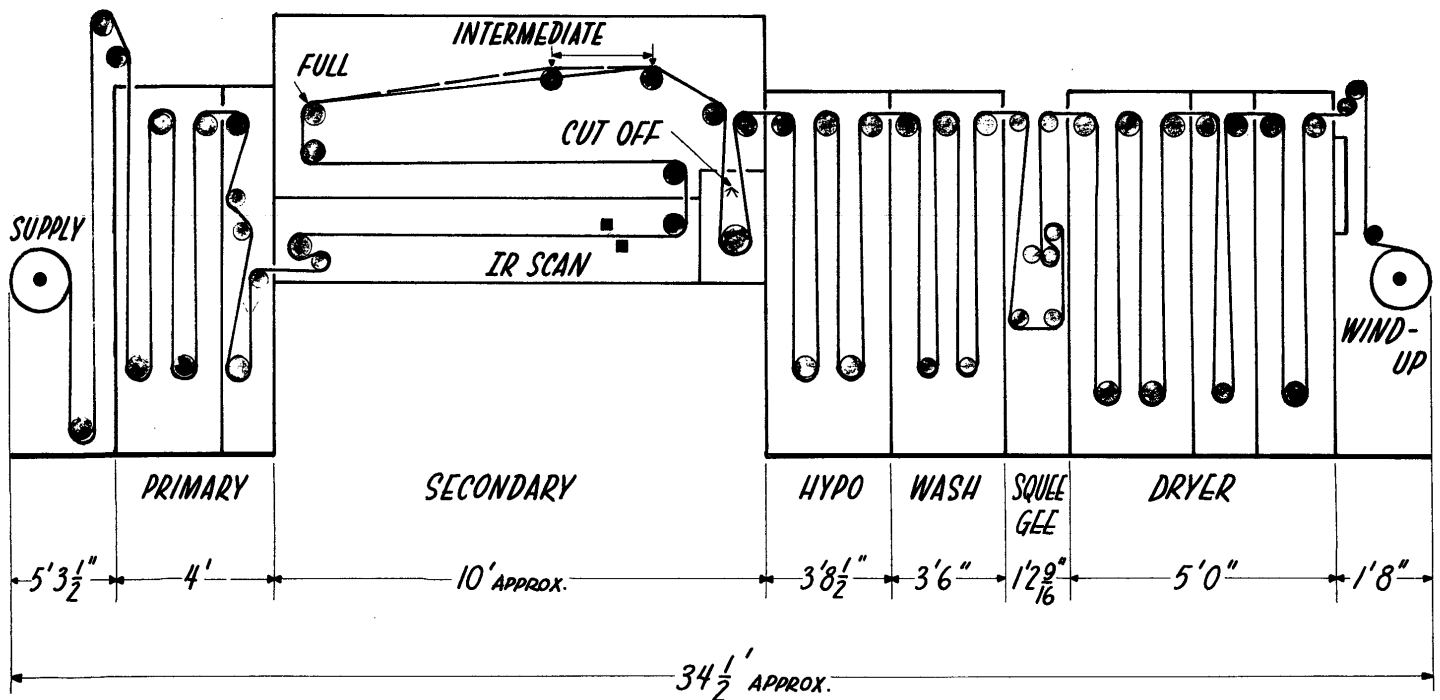


# ***PROPOSED 3 LEVEL F×F PROCESSOR (PROTOTYPE) Fig 3***



# $9\frac{1}{2}$ " FRAME-BY-FRAME PROCESSOR

Fig 4

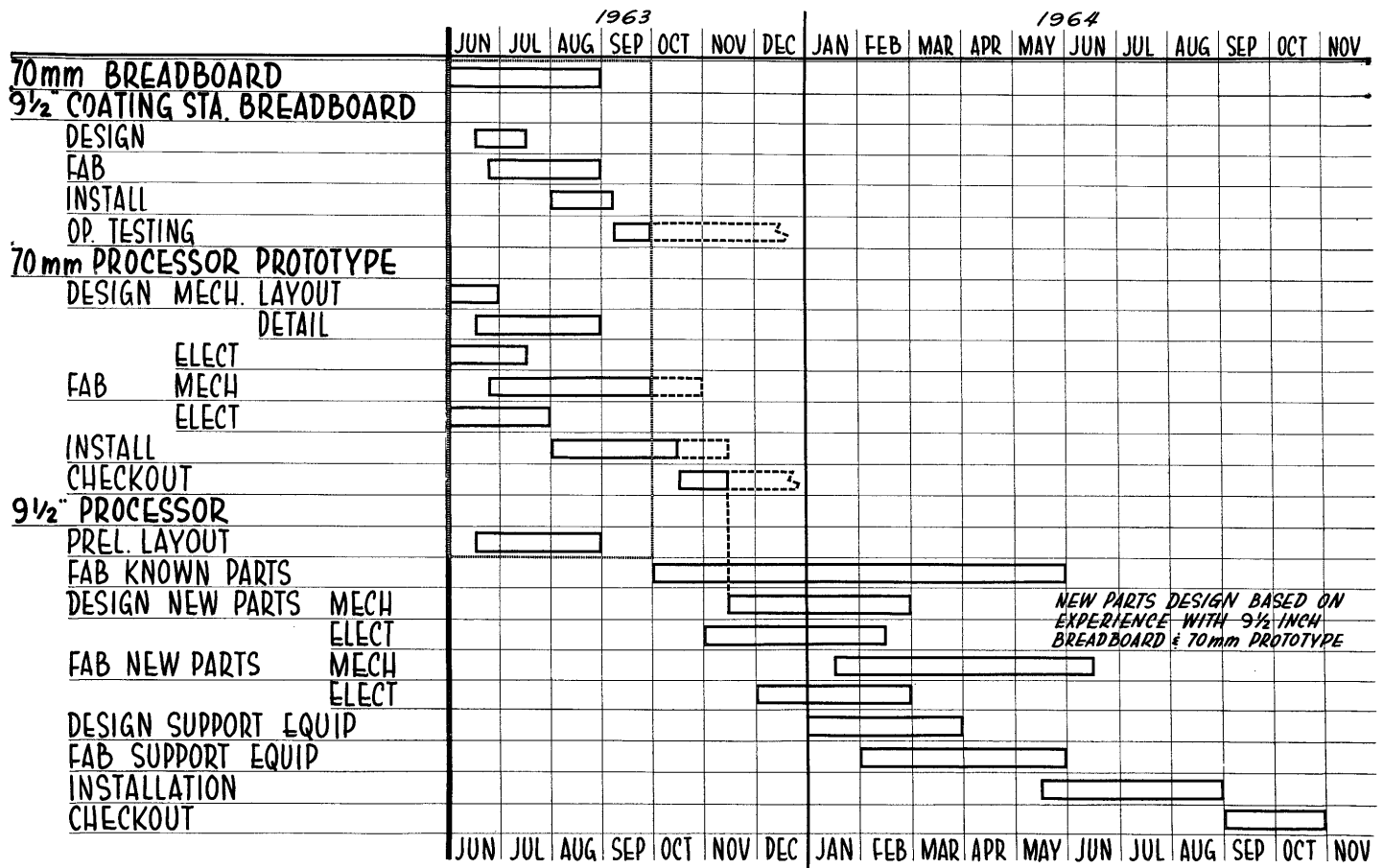


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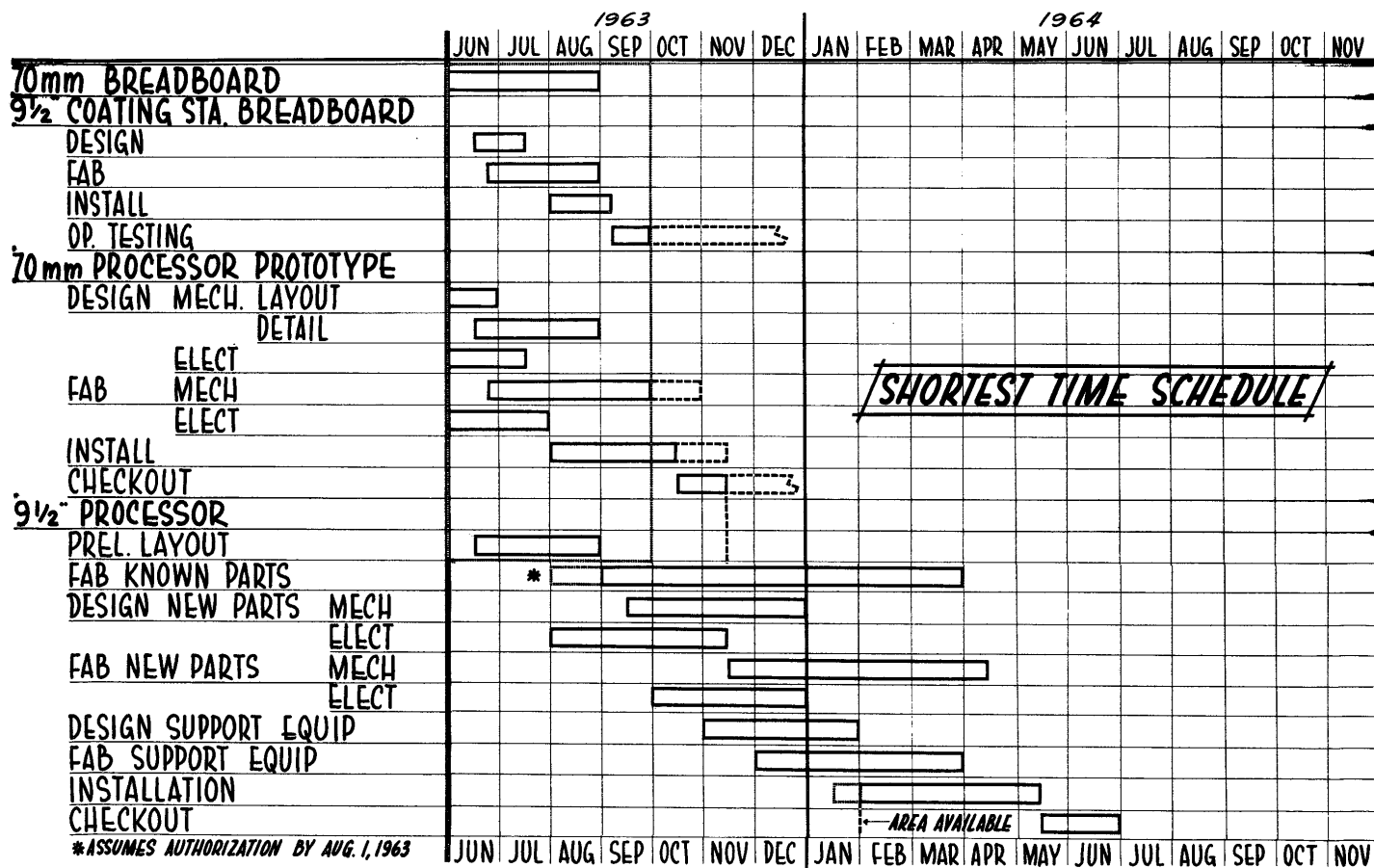
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# FRAME-BY-FRAME PROCESSOR PROGRAM SCHEDULE



## FRAME-BY-FRAME PROCESSOR PROGRAM SCHEDULE



Our R & D efforts under Contracts  may be  
grouped into five general categories.

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1. Processing
2. Printing
3. Titling and Handling
4. Evaluation Program
5. Miscellaneous Equipment

In approaching this development program we have had a  
threefold goal.

First, we have sought to improve existing equipment and  
techniques by the modification of present designs and procedures to meet  
more exacting standards of quality and productivity.

Second, we are seeking to develop new techniques to handle  
problems of the immediate future by the design, construction, and testing  
of pilot models and running tests on present equipment where feasible.

Third, we hope to anticipate the requirements of future systems  
by planning and experimentation with designs and methods not yet established  
in photographic art as applied to our problems.

The following section lists each individual project with a  
general statement of the problem and aims, and (a) the contractual position,  
(b) the estimated factory cost, (c) summary of activity to date, and (d)  
anticipated expenditure through FY-63.

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(1)

PROCESSING

Trenton Recorder and Automatic Warning Device (PAR #22)

The amount of data which is required relative to processing conditions throughout a mission has been constantly increasing. It was therefore felt that for purposes of analysis an automatic record of the Trenton operation would be desirable. This device will record processing level, I.R. densitometer readout, and operator action on the Trenton machines. Hard copy is printed on paper tape and will serve as a permanent record. The warning device allows six preset footage counts to alert the operator to any known problem areas in the negative roll.

When this development is checked out a similar unit should be installed on our second machine and the Trenton at SPPL.

(a) This is a minor project under contract [REDACTED]

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[REDACTED]

(c) [REDACTED] - Delivery date early August.

[REDACTED]

Automation of I.R. Densitometer (PAR #10)

The present I.R. Densitometer on the Trenton Processor is semiautomatic, requiring operator attention to determine areas to be scanned and to carry out the instruction of the scanner. This development will produce apparatus which will automate the entire scanning operation as well as performing action at the command of the scanner output. The apparatus will be primarily electronic control circuits and I.R. detectors added to the present I.R. scanners.

This development will be applicable to similar processors (SPPL Trenton) located elsewhere.

(a) This is an approved Significant Project under Contract

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(c) A prototype frame line detector has been built utilizing the principles developed for the frame-by-frame processor and checked out. Pneumatic edge guides have been ordered and the specifications for the transducer are being prepared.

Improvements to Existing Processing and Printing Techniques (PAR #23)

While present techniques for printing and processing preserve nearly all the information contained in the negative, we recognize that there is always a need for improvement.

It is the purpose of this project to investigate modifications of present techniques to improve quality and quantity (production rate) and to reduce cost. This will include the establishing of optimum processing cycles for a given material on equipment not previously used for processing this material. Further tests and studies on the optimum density and contrast levels for duplicating systems will also be included.

A major task within this project is to establish standard methods for the operation of various types of equipment found in the field.

- (a) This was submitted as a Significant Project under contract  STAT
- It was reduced to a minor project when it was not approved but we still feel that it should be approved as a Significant Project.

- 
- (c) The results obtained under this project are discussed in Appendix B.

Investigation of Improved Versamat Processing of Emulsion 8402 & 5427 (PAR #37)

Recommended Versamat processes for these two emulsions have serious limitation from the standpoint of the ultimate use of these films in the intelligence community. Each requires its own developer and is subject to certain sensitometric limitation imposed by the specified process.

Preliminary testing has indicated that it is feasible to use one developer to process both emulsions and that some variation in 8402 development level can be achieved with only minor changes in contrast by varying processing time only. This project will standardize this procedure for use throughout the community and result in:

1. A more versatile Versamat process for 8402 film - (currently limited to intermediate processing condition only).
2. Reduction in the number of different processing chemicals which may be supplied.
3. Elimination of the change over from one developer to another when changing from original to duplicate processing.
4. Providing process control by means of machine speed variations which can be made quickly in preference to temperature control adjustments which are necessarily slow.
5. A sizeable reduction in the weight of chemicals needed. As an example the shipping weight of chemicals required to process 10,000 ft. of 8402 original plus one duplicate copy of like footage would be reduced from 750 pounds to an estimated 150 pounds.

(a) This is a minor project under contract

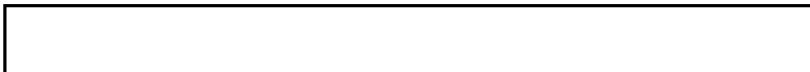
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(c) To date, we have achieved the processing conditions which shift the process toward either the full and primary development conditions to achieve a total shift in film speed of approximately one stop.

With the same chemistry but at a different processing condition  
Type 5427 can also be processed to a near 1.0 gamma duplicate  
process.

Further testing is required to determine the stability of the  
chemistry when processing of these films for extended periods  
of time.

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Conversion of the Grafton to Reversal (PAR #40)

It has long been felt that we should have an adequate inhouse capability for reversal processing. This opinion is further supported by substantial evidence that this may be one of the more satisfactory approaches to the problems of radiation fog and the preservation of maximum information through multiple generations.

Now that the Trentons have thoroughly proved themselves for the processing of original negative materials, the Grafton processor may be considered available for modification to a multiple station machine capable of handling a variety of materials requiring the use of up to ten different solutions simultaneously.

While the original concept of this conversion was to make a machine for standard reversal processing, it is now evident that by careful planning for the proper tank sequence the machine will also be adaptable to certain color processes. As laid out, the modified Grafton will be capable of handling the following:

1. Standard B & W reversal process for 8430, etc.
2. Special B & W reversal process for SO-105.
3. Color films requiring the ME-2B Process, such as Ektachrome.
4. Color films requiring the E-3 process, such as I.R. and SO-271.

(a) This is a proposed Significant Project under Contract

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(c) Only the planning and estimating has been done.

(d) No Expenditure in FY-63.

Conversion of the Speltron to a Color Processor (PAR #41)

In order to complete our capability to handle all four types of color materials we propose to convert the Speltron machine which is no longer required for the interrupted processing of mission material.

This unit will be set to handle the C-22 and P-122 processes used in negative-positive color system for Ektacolor or Kodacolor.

(a) This is being submitted as a Significant Project under contract

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[Redacted]

[Redacted]  
(c) Only the planning and estimating have been done.

(d) No expenditure is expected in FY 63.



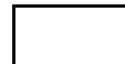
Modular Processor (PAR #28)

In view of the increasing complexity of processing cycles and the variety of products including various color materials to be handled it appears that flexibility will become a major virtue in a processor. There are at least a half dozen different methods of solution applications, each of which has its own advantages and disadvantages.

Processors today are somewhat limited in their application and each major problem such as color, black and white, reversal, etc., requires a new machine. It was our concept that, with sufficient thought, we could design, once and for all, "modules" which could be combined to satisfy any probable requirement. Since both color and reversal processing will probably be extremely important in the near future, we considered that manufacture of an entire prototype machine would be useful. The first phase of this project would result in two distinct advantages. Firstly, when a new processor was needed, it would be only a matter of selecting for fabrication the required sections thereby providing better service through the elimination of the time required for design and secondly, when a process change was required different or additional modules could be added with a minimum delay.

This area of investigation was one of those specifically mentioned in the Statement of Work (paragraph 3.2d).

(a) This was submitted as a Significant Project under contract



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- (c) Since this project was never approved no work has been done but we feel strongly that we should proceed with the study phase at least
- (d) No expenditures have been made on this project.

(2)

PRINTING

Investigate 400 Watt Mercury Arc Lamp for use on Printer (PAR #6)

Improved light sources for printing are always needed. This project covers the investigation of one such source including the power supply, mounting and practical tests on a Niagara printer.

(a) This is a Minor Project under Contract

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(c) This project is complete. The report (Appendix C) shows that there was some improvement in light output but not to the extent expected.

Scanning and Recording Densitometer (PAR #5)

In making quality prints from aerial photography much skilled operator time is required in spot densitometry of selected image areas, and computation of exposure prediction for the printer. We propose to develop a scanning densitometer capable of reading stationary or moving film and equipped with recording devices to aid in the exposure prediction. Successful completion of the development program will provide an engineering model capable of scanning selected areas of 70mm to 9 $\frac{1}{2}$ -inch wide film and of providing graphs of pertinent data for exposure prediction.

(a) This is an approved Significant Project under Contract

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(c) Specification No. 308 has been prepared and a quotation received which seems high. We are soliciting other quotations.

Frame Detecting and Counting (PAR #9)

This development will consist of sensors and control electronic which will detect frame lines in a roll of processed film. Its output will be settable to any frame number and will add or subtract as frames are detected. It will be particularly useful on the printers for locating sections of a roll to be reprinted. It will also be adaptable to any other operation, such as breakdown or make-up, enlarging and correlative reference where only particular frames need to be located.

(a) This is an approved Significant Project under Contract

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(c) Initial work on this project has just started because preliminary work has been carried on under the frame-by-frame processor program where the problem is very similar. The chief problem lies in the discrimination of frame lines under adverse conditions.

Develop Improved Tracking Techniques for Existing Printers (PAR #20)

It was felt that improved tracking in the printers could lead to better over-all quality and to the simplification of subsequent operations. This would be particularly true with regard to the three strand printing of 70mm material on 9-1/2-inch duplicating stock at SPPL. This project covers the installation of "air rollers", flanged guides, and some minor modifications to an existing printer.

(a) This is a minor project under contract

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(c) Modifications have been made and new parts installed.

Initial tests show a maximum deviation of .020 inches.

More tests will be run.

Frame-by-Frame Exposure Control Printer (PAR #13)

This project consists of developing a printer which is capable of changing light level delivered to the printing gate during the interval involved in the passage of the interframe spacing under the gate. This will provide different controlled levels of exposure for each individual frame. A paper tape reader will provide input signals necessary to adjust illumination for each frame of the roll. The printer will be of the Niagara type with the additional capabilities described above. Such a printer would be invaluable in field installations where frame-by-frame processing is not available or impractical.

(a) This is an approved Significant Project under contract

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(c) The mechanical design is nearly complete. The indexing shutter has been breadboarded and tested and the density control package is being assembled for trial. The control circuit design is complete and chassis construction is underway.

Bidirectional Reprint Printer (PAR #17)

The Bidirectional Reprint Printer will be developed specifically for the reprint task. The design will attempt to maintain existing printer characteristics, such as resolution, speed, and contrast and in addition provide a convenient mechanism to allow the reprinting of short lengths within a given length of original material. Rapid, safe slewing of negative material without unthreading will be a design goal. In addition the problems of alignment and tracking will be studied with the aim of developing a unit capable of printing full rolls in either direction. While this is a project in which SPPL has indicated a special interest, the printer would also be generally useful particularly in smaller less skilled installations where the need for reprinting may be higher.

(a) This is an approved Significant Project under contract

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(c) Design is complete, and the basic printer (a Niagara) and the additional parts are in work.



Experimental Continuous Slit Color Printer (PAR #18)

With the probable advent of color materials for strategic missions there will be a need for a continuous slit color printer for production of duplicates. We propose to develop such an experimental color printer with manual color filter controls to be used in establishing future color printer criteria as they apply to reconnaissance photography.

(a) This was submitted on a Significant Project under contract

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(c) The light source and filter pack, which are main developmental items are designed and fabrication has started.

Investigate 1000 watt High Pressure Mercury Arc Lamp for Printers (PAR#36)

Higher resolution duplicating materials require increased printer light output. Materials, such as SO-105 having the capability of providing maximum resolution through multiple generations typically require 20 to 50 times more energy for printing than is required by the materials currently used.

We propose to investigate the 1000 watt mercury lamp as possible source for printing these slow materials.

(a) This is a minor project under contract

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(c) Electrical components have been purchased and are being assembled.

Preliminary testing is due to start by 1 July.

Design and Build a Printer Lamp Test Fixture (PAR #39)

New light sources are continually being investigated for use in the continuous printers. This device is an engineering laboratory tool for comparative testing of such light sources. Adaptability, simplicity, and moderate cost are primary concerns. Darkroom loading will be required.

(a) This is a minor project under Contract

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(c) This project is a new proposal.

(d) No expenditure is anticipated in FY 63.

Lens Design for 3.6X Reduction (PAR #2)

The need for a system whereby 9 $\frac{1}{2}$ -inch films may be reduced to 70mm for archival storage has been recognized, particularly in the outlying laboratories where suitable storage space may be at a premium. The mechanical portion of a reduction printer for this use is well established but a high quality lens with the proper characteristics is not available. This project should furnish the design for a suitable lens.

(a) This is a Minor Project under Contract

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(c) The design has been received from  and is

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being evaluated both as a reducing and as an enlarging lens. If the design is satisfactory we propose to submit a request for a Significant Project to produce and test a sample lens made to this design.

Unsharp Masks (PAR #11)

One of the well established methods of image enhancement is the "unsharp mask" technique. While this is normally applied to single frames, we propose to investigate mask materials and methods for employing this technique on a continuous basis for high resolution, small scale, satellite photography.

Initially we will make masked prints using print-out materials in a frame printing arrangement with various amounts of unsharpness in the mask from small scale material. This will provide samples by which we may evaluate the ability of this technique to provide more useful reproduction material.

In addition, there should be control data from test target material handled under the same conditions showing resolving power and modulation transfer function data of both the print and of the masks and the sensitometric characteristics of the process. This should give us the necessary basic data upon which to base the design of a continuous system.

(a) This is a Minor Project under Contract ☐

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(c) Print-out mask material has been obtained and preliminary work has been done on determining the required exposure level and on producing suitable the MTF targets for analysis of the quality of the product of the proposed system.

Automatic Exposure Control Printer (PAR #4)

Present day high speed continuous printers such as the Niagara printer can be manually set to a fixed exposure level but cannot vary the exposure within a single roll.

This proposal covers a fully automatic exposure control printer in which the negative is scanned and the exposure level set by the logic circuits on the basis of the densities read by the scanner and the basic criterion preset into the system. Such a system will provide good exposure compensation for gradual changes in negative density but cannot follow frame-by-frame changes.

This should work ideally to bring to a common level the output of the current interrupted processing of the negative and will eliminate the manual density reading and recording now required and reduce the number of parts into which a mission must be broken.

(a) This was submitted as a Significant Project on Contract

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(c) The scanner, lamp and associated circuitry is complete and has been checked out. The next phase will be to mount these parts on a printer for further tests.

(3)

TITLING & HANDLING

Model III Titler (PAR #33)

The complexity of the titling problem has steadily increased as formats and operational parameters have become more varied and sophisticated. Recently, titling requirements have been defined for the L and G programs and as anticipated, are beyond the capability of existing equipment such as the Dual-Head Titler.

It is the purpose of this project to develop the necessary hardware and techniques for a more flexible and versatile titling machine. It is proposed to develop movable type titling heads which will permit random, high speed, parallel input. Such a device would allow frame-to-frame title changes, in a variable field as well as accommodating the fixed data for each frame. Logic circuitry will be designed to accept input from punched paper tape.

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(a) This was submitted as a Significant Project under contract

(b) Estimated Factory Costs:

Phase I - Preliminary design, engineering, and exploratory tests

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Phase II - Design, build and test an operating breadboard

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(c) Phase I has been subcontracted to  and the work is nearly complete.

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(d) Anticipated expenditure in FY 63

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Frame Coding and Detecting System (PAR #8)

Throughout the community there is a need for finding rapidly a given frame within a roll of film. Under this project we will investigate methods for incorporating on the titlers a device reproducing the frame number in coded characters. A reader and coincidence electronics circuit placed on roll viewers, printers, splicers, etc, will be capable of locating specific pre-selected numbered frames for exposure control, cutting, or viewing. Both dupe positives and dupe negatives will have the same coding.

(a) This is an approved Significant Project under Contract

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(b)

(c) Active work directly on this project has just started.

Preliminary investigation was carried out under a titler development program.

Optical and electrical approaches to the problem are being evaluated with particular reference to the problem of reproduction on succeeding generations.

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(d)

(L)

EVALUATION PROGRAM

Investigation of New Commercial Components and Materials (PAR #7)

As a new commercial components and materials of possible usefulness in our field of interest come to our attention, we propose to purchase or fabricate parts for test purposes.

This authorization is to cover those cases where our interest is general or where the charges cannot be assigned directly to a currently active project. Individual subprojects are to be limited to  maximum.

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(a) This is a Minor Project under Contract

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(b)

(c) A list of items purchased and the test results to date are given in Appendix D.

(d)

Evaluation of New Materials and Processes (Red Dot Tests) (PAR #24)

As new and improved films and film-process systems become available it is necessary to evaluate their applicability to specific reconnaissance systems and requirements, and to determine proper exposure, latitude, spectral region, and processing. This task will include the necessary high altitude flight testing, production processing, and analysis required for satisfactory evaluation of the materials.

A detailed test program (Appendix A) within the scope of this project was submitted for approval as requested in the communication of 15 April. Since these tests form the basis upon which many important decisions must be made relative to the selection of materials and processes for current and future operations, and since the [ ] on expenditure is upon us, we urge immediate favorable action on the project authorization request.

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(a) This was originally submitted on a Significant Project on Contract [ ]

(b) [ ]

(c) Several color photographic films were evaluated for use in reconnaissance systems. This work included the evaluation of color duplicating films for reproducing the original and evaluating the stereo potential of a stereo pair, when one of the pair is color and the other black and white.

These investigations provided the fundamental data required for preparing the specifications for equipment needed to continue further work with color films, such as modifications to the Grafton and the Trenton.

Appendix A summarizes the entire program from its inception in 1958 through a proposal for future tests.

(d) [ ]

In this project a study will be made of the effects of high energy radiation exposure on photographic materials. Tests will be run to evaluate methods or techniques which may be employed to counteract these effects.

(a) Approved Significant Project on contract

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(b)

(c) One method of counteracting the effect of high energy radiation exposure on type 4404 negative film is to utilize special processing techniques. A reversal process followed by image intensification shows promise.

To date a preliminary study has employed a laboratory sensitometric processor in order to compare conventional negative processing techniques to that of the specialized reversal - intensification method for the radiation range of 0 - 600 roentgens.

The specialized method consists of a series of steps which allows for the inspection of the film at various stages. Following is a listing of the major steps in this method:

1. Develop the negative image.
2. Using an Infra Red viewing technique determine whether or not conventional processing is satisfactory.
3. Assuming (from 2 above) that conventional processing is not acceptable complete the reversal process.

4. Inspect material from 3 to determine what level of intensification is desirable (silver and/or dye intensification). The degree of intensification used would be a function of the total radiation received by the film.

Test data collected on Type 4404 film to date indicates that:

1. Film subjected to radiation levels up to 100 roentgens produces optimum results when processed in a conventional negative process.
2. Intensification of irradiated reversal images improves overall sensitometric quality and at the same time provides a master record of normal density image.
3. The reversal-intensification technique shows marked improvement over conventional negative processing of film which has been subjected to 100 or more roentgens of radiation.
4. The degree of intensification necessary to correct the detrimental effects of radiation is dependent upon the level of radiation.
5. Resolution of negative images yields 430 l/mm in comparison to 380 l/mm for the reversal image at a 0 roentgen level.
6. Reversal processing type 4404 film does not introduce any significant photographic speed loss compared to conventional negative processing.
7. The dye intensification process does not introduce any significant photographic speed losses.

As indicated by the results obtained from laboratory test equipment, a reversal - intensification technique offers promise for obtaining useful information from irradiated photographic records. To initiate a more thorough testing procedure, a large scale reversal processing machine is necessary. In addition, a separate intensifying process unit may be desired for practical operation. A versatile reversal processing machine would, however, have the capability of being used as an intensifier subsequent to reversal process operations. (See PAR #40)

(d)



It has long been recognized that the study of microdensity of the photographic image should lead to a better understanding of factors influencing the information content of such images.

In this study the microdensitometer will be used as a measuring tool. Data reduced from the microdensitometer traces can provide information based on scientific measurement which should help indicate the consistency and repeatability of photography within a mission as well as providing data for comparison of one mission to another. These measurements would be made on a wide variety of input material available to this laboratory and as more data is collected and analyzed, it is probable that direct correlations can be made to system performance.

Special practical tests may be required to evaluate the effectiveness of the evolved techniques and to insure reliability of the methods used.

- (a) Approved Significant Project on Contract  STAT
- (b)  STAT
- (c) Aerial scenes having typical urban detail have been examined by scanning edges on the microdensitometer. In the case of 9-1/2-inch film, having a scale of approximately 1:23,000 detail is plentiful and scanning is easy. For film which has a much smaller scale, such as 1:330,000, it is difficult to find suitable long, straight edges for measurement purposes. The microdensitometer traces of edges found in the terrain format have been analyzed using two techniques. One technique reduces the edge trace to a plot of the "system spread function", the other to the "system modulation transfer function". Data requested by either technique includes the composite of the functions of each element in the system including the characteristics of



-2-

the edge being analyzed.

Analysis of the "system spread function" data from the 9-1/2-inch film system indicated a high degree of correlation between the spread function and resolution.

Recently a number of edges were scanned on 70mm photography. These data were collected from various sections of the frame format on both the master and slave units. These data are currently being reduced to both the system spread function and the system modulation transfer function.

(d)



Exposure Control Criterion (PAR #19)

There continues to exist a large gap in practical data necessary for the more intelligent development of a printer automatic exposure control unit. A scanning control unit for the printer is being developed which is based almost entirely on a theoretical print criterion with very little practical data backing up its selection. This criterion may prove to be satisfactory, but a high probability exists that its performance will be poor or at least not optimum.

With a larger input of measured and processed data obtained from mission negatives, it should be possible to modify the electronic control chassis of the development scanner to obtain a high yield of satisfactory prints. A full treatment of this criterion study could cost two to three thousand dollars. It would be desirable to start moderately with a fund of  to collect and process some initial data to determine if it is practical to continue. This initial program would consist of collecting measured data from the present operation, supplementing this with additional measurements, processing this data on a computer and evaluating and testing the results.

- (a) This is a minor project under contract
- (b)
- (c) Some data has been collected and is being analyzed. More will be included as suitable source material becomes available.
- (d)

Ultrasonic Splicer (PAR #32)

As long as we have to join two pieces of material the need for better splices will exist. The ultimate aim is a splice which will be undistinguishable from the parent stock and lose the minimum amount of information. Ultrasonic splicing is one approach to this problem.

We have purchased [ ] a commercially available STAT  
splicer of the ultrasonic type to determine the usefulness of such devices in our application. The possibility of very narrow splices with a minimum increase in material thickness appears to exist if such splicing means can be applied to the variety of materials and coatings now being used.

(a) This is a minor project under contract [ ] STAT

(b) [ ]

(c) An ultrasonic splicer has been purchased with [ ] funds from STAT

[ ] and has been tested. While certain mechanical modifications need to be made to the splicer before we would consider our test results definitive these tests indicate that polyester (Estar) based films may be spliced with fair reliability, and Triacetate based films may be spliced with probably acceptable reliability for non-critical application. Suggestions for redesign are being formulated.

(d) [ ]

Ultrasonic Cleaner (PAR #31)

STAT A [ ] Ultrasonic Cleaner has been obtained (GFE) and we propose to investigate its usefulness as a means of cleaning both raw stock and processed materials. Particular attention will be given to any sensitometric changes produced in the raw stock, and to the preservation of information in processed material.

(a) Originally submitted as a Significant Project under contract

STAT [ ] This has now become a minor project since we have the cleaner as GFE.

STAT (b) [ ]

(c) Testing is just starting on this project.

STAT (d) [ ]

(5)

MISCELLANEOUS EQUIPMENT

Design & Fabricate Prototype Roll Holder for 10-20-40X Enlarger (PAR #1)

In the operation of the 10-20-40X Precision Enlarger one of the most time consuming operations is the handling of cut-sheet print stock. We have had many comments from the Air Force Intelligence Community concerning the lack of a Roll Holder for this equipment. We, therefore, undertook as a Minor Project the development of a simple, manually operated holder with roll supply and take-up for 9 $\frac{1}{2}$  inch wide stock.

The Roll Holder and a new supporting bracket replaces the present cut-sheet platen, bracket and vertical slide assembly. Titles will be applied to the printer by a transparent title frisket laid within the image area as the print is being exposed. The holder will also accept a 10 x 12 cut-sheet of print stock if a roll web is not in place.

(a) This is a Minor Project under Contract

STAT

(b)

(c) The Roll Holder has been designed and is now being fabricated. Delivery is expected in mid July.

(d)

Improvements on the Microdensitometer Mod. 5 (PAR #14)

In the use of the Mod. 5 Micro D as a tool to analyze images on mission materials it becomes evident that certain convenience modifications were desirable. This project was taken out to cover such changes which include the addition of stock rewinds and cable releases and the relocation of controls for greater convenience.

(a) This is a minor project under contract

STAT

(b)

(c) The necessary parts have been sketched and are being made.

(d)

Redesign Microscope Resolution Target Camera (PAR #12)

In the development, testing and maintenance of high performance photographic printers, both in-house and at SPPL high quality test target material is needed. As the resolution on original material becomes constantly better, the demand for high quality test material will continue to increase.

We have built and are using successfully a 20X Resolution Target Camera. An interchangeable Microscope Camera Unit was also provided in that project. However, the increased demand for test material makes it desirable to have both the 20X and the microscope camera units operable simultaneously. We propose to develop a new model of the RTC specifically for the use of microscope optics in the production of test patterns up to the range of 800 to 1200 lines/mm. In this new development program we expect to include: (a) operation of the camera by a seated operator, (b) finer control of objective focus, (c) easier handling of print stock, and (d) means to help a user find the microscopic test patterns on the large pieces of test film. As in the original 20X RTC, print stock from 70mm to 9-1/2-inch wide and up to 100 feet long can be accommodated. These changes where applicable will also be made on the 20X Camera Unit.

This should be an asset to major installations such as SPPL when there is a need for an in-house capability for generating test targets for specific applications.

(a) This redesign was carried on a minor project under contract

☐ We are now requesting approval of a Significant Project to cover the building of the redesigned unit.

(b) Estimated Factory Costs:

Phase I Redesign  
Phase II Build and Test

☐



(c) The redesign is complete and the cost of fabrication installation and testing estimated. We now await Significant Project approval.

(d)

STAT

Color Corrected Lens for 20X Enlarger (PAR #3)

Phase I - Design of a Special Lens

With the imminence of color it becomes necessary to develop a high quality color lens. The maximum enlargement which color film will be able to sustain for the foreseeable future is 20X. Therefore, the object of this phase is to perfect the design of a high quality enlarger lens suitable for use in 20X magnification. This magnification was selected since it will fit both the 20X and 10-20-40X Enlargers currently in use and approaches the acceptable limit of magnification of original color materials now available.

The present 20X lens is corrected for only a narrow spectral band and is, therefore, not suitable for use in high quality enlarging with either polycontrast or color materials.

Phase II - Test of an available Lens

Recently we have learned of a 52mm [ ] document projection lens, which might meet our requirements, is available on loan. We propose to make the necessary adapters, borrow the lens, and test it on the 10-20-40X Enlarger.

STAT

(a) This is a Minor Project under Contract [ ]

STAT

(b) [ ]

(c) The design called for in Phase I has been subcontracted to [ ] and is expected to be completed by mid July.

The necessary adapters for mounting the [ ] Lens (Phase II) are being fabricated. The lens should be ready for test by early July.

STAT

After evaluation of the design and the [ ] sample, a decision will be made regarding the fabrication and testing of a sample lens made to the [ ] formula.

STAT

(d) [ ]

9-1/2-Inch to 70mm Slitter (PAR #23)

Niagara printers are capable of printing three strands of 70mm negative onto one 9-1/2-inch web of print film which can be slit into individual strands after processing.

We have built for delivery to SPPL in the near future a pair of prototype slitters for obtaining three 70mm film strands from one 9-1/2-inch web. This involves a two operations, coarse slitting followed by a trimming to 70mm.

We propose to develop and design a 9-1/2-inch to 70mm slitter which will permit slitting three strands of final 70mm product directly from 9-1/2-inch product wound on B type spools as received from the processor. Edge sensing and tracking control methods will be studied as a means of reducing accumulated tracking errors and to provide a general design which will reduce the number of production operations. This development is predicated on the successful conclusion of our efforts to improve the tracking on the Niagara through the use of air rollers (PAR #20).

(a) This is a minor project under contract

STAT

STAT  
(b)

(c) Only planning has been done.

(d) No expenditure is anticipated in FY 63.

APR 25 1963

Appendix A

## Proposal for the Red Dot Program

During the period from 1956 through 1958, a number of high altitude flight tests, identified as Red Dot, were made to determine the combination of film, filter, process and exposure needed to produce the best operational results in the Idealist program. The test results were published in a comprehensive report, "The Characteristics of Aerial Photographs Taken From High Altitudes, Part 1: Recommended Exposures", dated November 14, 1958 and "Part 2: Image Quality Comparisons and Photometric Data from Red Dot Tests," dated December 24, 1958, which were distributed to those involved. The film, filter, process and exposure combination selected as a result of this test series has remained essentially unchanged in the Idealist program.

In addition, the photometric data obtained from the flight photography was used to establish an empirical relationship between solar altitude and photographic exposure. This relationship, described in Part 1 of the Report, has been the basis of our exposure recommendations for both manned and satellite reconnaissance systems introduced since 1958. The so-called "Sun Angle Curves" have been widely disseminated to those involved in the design and operation of these systems.

The Report recommended that additional tests be flown under carefully controlled conditions, and a few have been made since that time. The last tests were run in the latter part of 1961, and a summary of the results are reported in Attachment 1.

We consider additional flight testing to be within the scope of the present RDX Contract. There is a definite need for renewed effort to update our scientific knowledge in this area. New films and processing methods have been successfully put into operational use, and precise technical information is needed about their characteristics under practical operating conditions to further improve the state-of-the-art. Still other new films and processing methods await practical testing to demonstrate their capability. There has been a growing divergence of opinions concerning optimum photographic exposure, and additional testing is required to arrive at sound decisions firmly supported by facts.

Attachment 2 shows an outline of the flight testing proposed for 1963. We estimate that fifty flights will be required to complete the entire test program. To

a considerable extent, the actual number will depend on how well the equipment, materials, and manpower required can be coordinated so that a single flight or several consecutive ones can serve a number of objectives.

Research and development on sensitized materials is a continuous program in the Eastman Kodak Company, and considerable activity is directed toward aerial materials. During the year, we expect to add new items to those already outlined as these R & D efforts prove fruitful.

Attachment 3 shows a detailed test plan of Item 2C in the outline, Tri-color Separation for Color Analysis. This test plan is included as an example of one specific phase of the color study, and one that could profitably be run in the near future as background for further work.

New ground test objects are needed to obtain the greatest amount of information from these flights. We have been studying the feasibility of measuring the performance of a photographic system in operational use through the use of microdensitometry, and new test objects would be particularly beneficial in this study. The ground test objects should meet the following general specifications:

1. Locate in a city so that microdensitometer traces of common man-made objects and the resolution targets can be compared directly within a frame.

2. Include resolution targets having sufficient bar lengths so that the microdensitometer can be used for measurement.

3. Include a target so that modulation transfer data can be obtained.

4. Include a gray scale having three or more steps and an instrument to record the illumination on the ground at the time of the aerial exposure.

Targets now existing in several locations in the Northeastern United States may satisfy most of these specifications, but these locations are probably inconvenient for frequent overflights. The Lockheed plant at Burbank may be one of the best locations for new targets, although some military installations in the same general area may also be satisfactory.

In brief, these tests are intended to provide the specifications for further research and development, and to bring these efforts from the laboratory into

- 3 -

operational use at the earliest possible date.

The necessary equipment and materials for some tests can be available approximately sixty days after approval. Additional information on the availability of vehicles and equipment will be needed to plan the complete series.

ELG:TLS:slc

Attachment 1

Red Dot Series M Test Summary

M-1 and M-2 - Objective was to compare Experimental Panatomic-X Aerial Film, Type SO-130, Panatomic-X Film, Code 5240 and Plus-X Aerecon Film (Thin Base), Type 8402 processed to gammas of approximately 1.0 and 2.0. The information content of the films processed for a lower gamma appeared similar to the same materials processed for a higher gamma. Exposure was not sufficiently well controlled between runs to permit a completely valid comparison. As expected, SO-130 provided the best image quality, followed by 5240 and then 8402.

M-3 - Objective was to determine whether the Idealist Program "B" Configuration could benefit from the use of films having finer grain than 8402. The flight test compared SO-130 and 8402 and showed that image quality could be improved in this system with finer grain films. At the present state of the art, the reduced film speed of the finer grain materials limits exposure to higher solar altitudes.

M-6 - The objective was to compare the results obtained from an experimental reversal color film in comparison with two conventional black and white films, Experimental Panatomic-X Aerial Film, Type SO-130, and Experimental Plus-X Aerial, Estar Thin Base, Type SO-102. Both black and white materials had superior image quality, but the difference was not large and may be substantially overcome by the information added by the color images. This test is the best comparison of a conventional color material with black and white materials to date.

M-7 - Objective was to determine the compatability of thin base Estar film in the "B" Configuration. Type SO-102 was flown and the results indicated that thin base Estar can be satisfactorily used in this system.

Attachment Two

Outline of Proposed 1963 Flight Tests

1. Exposure Determination - The objective is to obtain more precise information on the optimum exposure of black and white films. Previous tests have been aimed at this objective, but further tests are needed in the following areas:

- A. Newer Sensitized Materials. The high definition films have considerably reduced exposure latitude in comparison with the films tested in 1956-58, and consequently exposure aims must be determined to a greater degree of accuracy than was previously required.
- B. Newer Camera Systems. Our present knowledge is essentially limited to data obtained through the use of the two camera systems in the Idealist Program. Information obtained in other camera systems would increase the confidence of generalizing the data for all systems. The effect of scale and ground resolution on exposure should also be examined.
- C. Low Solar Altitudes. During the past year, operational satellite photography has been made at extremely low (even negative) solar altitudes. Additional test data should be obtained under these illumination conditions.
- D. Varying Atmospheric Conditions. The effect of varying atmospheric conditions on exposure need additional study aimed toward increasing the yield of operational photography.

Both tone reproduction and image quality are important criteria for determining the optimum exposure, and the latter criterion in particular requires more study. With the possible exception of the color testing program outlined below, this is considered the most important and will probably require more flights than the other tests combined. The Oxcart Program Type II Camera System or similar equipment will be required for many tests to obtain the exposure and image quality desired.

2. Color - The objective is to obtain properly exposed and balanced color originals to demonstrate the potential capability of obtaining additional information from color photography at very high altitudes in comparison with black



and white. Past tests have shown that the additional information in the color images has not compensated for the loss of image quality resulting from the use of existing color materials, but substantially improved color materials are now available. Further tests are needed in the following areas:

- A. High Definition Color Films. Limited flight tests were made last year with an experimental Kodachrome type color film exposed in the Oxcart Program Type II Camera System. These tests have shown the best image quality ever obtained with color materials and compare favorably with high definition black and white films. Both exposure and process are critical and additional effort is needed to produce optimum results. For assurance that the objective can be attained in a reasonable time, consecutive flights should be made with a new flight following the previous one as soon as the results can be evaluated. For these as well as other color tests, plans should be made to include a variety of scene types and vegetation.
- B. Conventional Color Films. The image quality of these materials has been considerably improved and they may have application in systems not capable of utilizing the high definition material discussed in A above. Practical flight tests of these materials will also increase the available knowledge of color photography from very high altitudes. The processing of these materials is relatively straight forward in comparison with the high definition color film.
- C. Tri-Color Separation. Useful and precise data on the spectral characteristics of aerial scenes from very high altitudes can be obtained by exposing black and white film through tri-color separation filters. This information will be used to determine the optimum sensitometric characteristics of the specialized color films.

3. Reversal Process - The objective is to evaluate the results obtained from practical flight tests by reversal processing the taking film and subsequent positives compared with the conventional negative-positive system. The reversal method may provide improved image quality and reduce the effects of nuclear radiation.

Attachment 2 - Page 3

4. Contrast - Normally the contrast of aerial materials is reasonably high to compensate for transmission losses through the atmosphere, but the higher contrast is obtained at the expense of exposure latitude. Some laboratory work has shown that the same information can be obtained at a lower contrast.

This question is a rather fundamental one for high altitude photography, and additional tests are needed to produce a conclusive answer under practical conditions.

5. Stellar - The current interest in obtaining satisfactory stellar imagery for position location of satellite systems suggests the need for testing in this area. Variables to be explored include film, filter, process and exposure. Although we have not investigated the possibility, the Idealist Program vehicle may be a satisfactory test platform. By selecting the proper solar azimuth, it may be possible to simulate the conditions occurring at much higher altitudes.

Attachment 3

Detailed Test Plan, Item 2C  
Tri-Color Separation for Color Analysis

Objective - The objective is to obtain photometric data on the spectral characteristics of aerial scenes from high altitude in order to determine the optimum sensitometric characteristics of color materials specifically intended for this purpose.

Cameras - Tri-vertical A-2 Configuration with 24" f/8 lens matched as closely as possible. The same cameras should be used for all tests if possible.

Exposure - 1/125 TOT at f/8 nominal. The three cameras will have filter packs to be furnished which will contain special red, green and blue tri-color separation filters and neutral density compensating filters.

Film - Plus-X Aerial Film (Estar Thin Base), Type 4401 in 9 1/2 inch by 1800 ft. rolls will be used for all tests.

Process - Full development for all tests.

Test Conditions - A flight plan should be established to expose half or less of the film load and include as many scene types as possible listed below in order of preference.

- a. Urban
- b. Agricultural
- c. Water
- d. Coniferous forest
- e. Snow covered mountain
- f. Desert

The above flight plan should begin at such time that it can be completed prior to 1000 hours standard time and then repeated between 1000 and 1400 hours over the same targets. Altitude is K+20+3. Both minimum and slight to moderate haze conditions should be included if possible.

Three complete flights should be made with camera filters in the following positions:

	<u>Camera #1</u>	<u>Camera #2</u>	<u>Camera #3</u>
Flight #1	Red	Green	Blue
Flight #2	Green	Blue	Red
Flight #3	Blue	Red	Green

Note: Camera number applies to the instrument, not its location.

Attachment 3 - Page 2

Field Reports -

1. Camera number, lens number, aperture, filter.
2. Actual shutter speed before and after flight.
3. Flight Plan
  - a. Targets and headings
  - b. Time on targets
  - c. Altitude
4. Pilot comments on atmospheric conditions.
5. Post flight condition of cameras and windows.
6. Actual T-stop of each lens at f/8 and spectral transmittance of each lens.

Appendix B

Processing and Printing Improvements (PAR #23)

(Summary of Activity through 11 April 1963)

Processing standards were established for three Aerial Films on the Trenton original negative processing machines. Types 8402 and 4400 film required minimal effort in that previous processes had been established on older processing machines. Standards for processing SO-206 film required more detailed effort. Variations in process chemistry were made until an optimum balance in the photographic developers resulted in a system which combined the best features of film and machine.

A specialized Versamat process for Type 4404 film was developed to provide a field process which would approximate to the Trenton process. Standards for the full and intermediate processing levels were established using a developer similar to the type used in the Trenton negative machines. On the Versamat processor the desired processing condition must be predetermined prior to the process.

Materials for the sensitometric control of the photographic process in field installations were provided. These materials included:

1. 1B sensitometric exposures
2. Control stock for field sensitometric exposures
3. Processing instruction.

The Versamat and the sensitometric control data have been sent to the A/P facility and are available to other processing stations where the information may be useful.

Typical processing standards are attached.

DATE 4-11-63

MACHINE Trenton 1 & 2  
 PRODUCT Negative  
 EMULSION TYPE SO-206  
 SIZE 70mm  
 PROCESS EMULSION UP ☐ DOWN ☒

MACHINE SPEED DIAL SETTING 25  
 FILM STRIP SPEED 25 FPM  
 SECONDS PER RACK \_\_\_\_\_  
 THREAD-UP Primary - Skip Loops 8&9 Top of adj. rack at 15  
Intermediate - Top of adj. rack at 23  
Full - Skip loops 5&6 Top of adj. rack at 42

PROCESSING STAGE	CHEMICAL		(per.min.)		NO. R.	PUMP PRESSURE	NOZZLE TYPE	TYPE	AGITATION	
	TANK	RPL.	RPL. RATE	TEMP.					GAS	PRES.
Primary	D-19	D-19	2000 mls	68°±1°	1:47"	15 psi	K-3			
Arrest	SB5b	SB5b	1000 mls	70°±2°	4"	15 psi	K-5			
Wash	H <sub>2</sub> O	H <sub>2</sub> O	7 GPM	70°±2°	15"	15 psi	K-5			
Secondary	MPB11LD	MPB11LD	2000 mls	70°±1°	Int 17" Full 1:05"	full 15 psi	K-3			
Arrest	SB5B	SB5B	300 mls	70°±2°	3"			immersion		
Hypo Rinse	F-6	F-6	1300 mls	70°±2°	24"	15 psi	K-1.5			
Hypo	F-6	F-6	1300 mls	70°±2°	1:19"	15 psi	K-3			
Wash	H <sub>2</sub> O	H <sub>2</sub> O	10 GPM	70°±2°	1:40"	15 psi	K-3			
Photo-Flo	P-F	P-F	200 mls	70°±2°	1"			immersion		
Dryer				105°±5°	57"					
Condition Cabinet				95°±5°	1:25"					

DAMPER SETTINGS:  
 INTAKE none

EXHAUST Wide Open

VARIAC SETTINGS  
 LOCATION OR NO. OF WGTs.

Feed Carriage	2
Condition Cabinet	1
Take-off Carriage	0

COMMENTS:

Dry Cabinet selector switch 1  
 Top spray nozzles in primary  
 section turned up to break up  
 any run down of developer.

Approved For Release 2005/11/21 : CIA-RDP78B04770A001000040008-0 DATE 2/13/63  
 PROCESSING SPECIFICATION NO. 605

MACHINE Versamat  
 PRODUCT Negative  
 EMULSION TYPE 4404  
 SIZE 70mm thru 9 1/2 inches  
 PROCESS EMULSION UP ☒ DOWN ☐

MACHINE SPEED DIAL SETTING 13 feet/min.  
 FILM STRIP SPEED 13 feet/min.  
 SECONDS PER RACK 18.5  
 THREAD-UP Full

PROCESSING STAGE	CHEMICAL		Per Min.		TIME	NO. R.	P. MP RRESSURE	NOZZLE TYPE	AGITATION		
	TANK	RPL.	RPL. RATE	TEMP.					TYPE	GAS	PRES.
Developer	12DX90	12DX90	400 ml	85° ±1°	37"	2	Full development				
Developer	12DX90	12DX90	400 ml	77° ±1°	37"	2	Int. development				
(1 Tank) Stop Bath	SB56	SB56	200 ml	Room	18"	1					
(2 Tanks) Fix	Type A	Type A	400 ml	Room	37"	2					
Wash	H <sub>2</sub> O	H <sub>2</sub> O	8 Gals.	85° ±2°	37"	2	Cascading				
Dryer				120° ±5°	32"						

DAMPER SETTINGS:  
 INTAKE #2

EXHAUST #2

LOCATION	VARIAC SETTINGS OR NO. OF WGTs.

COMMENTS:

1 Tank of stop bath to eliminate mottle

Emulsion 50-206-3

Approved For Release 2005/11/21 : CIA-RDP78B04770A001000040008-0

Date 6-27-63

## EXPOSURE

Sensitometer 1B - 711-15  
 Filter Daylight  
 Exposure Time  $1/25$  sec.  
 $\log E_{11} = 1.30$

Experimenter \_\_\_\_\_ Date \_\_\_\_\_ Witness \_\_\_\_\_ Date \_\_\_\_\_

## PROCESSING

Fog Gamma 0.6 Gamma Speed

Full	.14	2.30	2.80
Int.	.11	2.14	2.96
Pri	.09	1.94	1.17

Process control standard curve  
 for use with process specification

612

Approved For Release 2005/11/21 : CIA-RDP78B04770A001000040008-0

LOG EXPOSURE

DENSITY

3.8  
3.6  
3.4  
3.2  
3.0  
2.8  
2.6  
2.4  
2.2  
2.0  
1.8  
1.6  
1.4  
1.2  
1.0  
.8  
.6  
.4  
.2  
0



Emulsion 4404

Date 2-13-62

EXPOSURE

Sensitometer 1B  
Filter Daylight 2F2 tablet  
Exposure Time 1/25 sec.

Log E 1.49  
PROCESSING 11

Experimenter \_\_\_\_\_ Date \_\_\_\_\_ Witness \_\_\_\_\_ Date \_\_\_\_\_

	<u>Fog</u>	<u>Gamma</u>	<u>0.6 Gamma Speed</u>
Full	.20	2.30	1.19
Int.	.12	2.44	1.39

11  
↓

Process Control Standard Curve  
For use with specification 605

10 June 1963

STAT  
To:

Subject: 400 Watt High Pressure Hg Lamp Tests in  
Niagara Printer

These data are published as a matter of record. Engineering does not contemplate the use of the H-400A33-1 lamp at this time.

1. Introduction

STAT  
1.1 The G.E. H-400A33-1 lamp was installed by  in Niagara #106. Several uniformity-compensating wedges were used in conjunction with the lamp. The effects on uniformity, resolution, and exposure level are noted.

2. Results and Data

2.1 Exposure Level

2.1.1 The Log E increase as compared to a 100 watt high pressure lamp (G.E. H-100-A4/T) in the model I Niagara, operating at approximately 150 watts, was .62.

2.1.2 The net Log E gain using uniformity compensating wedges numbers 23 and 24, was .35.

2.2 Illumination Uniformity

2.2.1 The  $\Delta D$  measured across a 9 1/2 inch processed on the Dalton, at a gamma between 1.00 and 1.10, was as follows:

2.2.1.1 Wedge #23,  $\Delta D = .09$   
Wedge #24  $\Delta D = .07$   
No Wedge  $\Delta D = .18$

2.3 Resolution

2.3.1 These data illustrate the effect on resolution of the illumination compensating wedges. Readings were taken across a 9 1/2 inch web.

- 2 -

- 2.3.1.1 Resolution on type 8430
  - 2.3.1.1.1 No wedge = 396 lines/mm
  - 2.3.1.1.2 Wedge #23 = 353 lines/mm
  - 2.3.1.1.3 Wedge #24 = 353 lines/mm
- 2.3.1.2 Resolution on type 5427
  - 2.3.1.2.1 No wedge = 198 lines/mm
  - 2.3.1.2.2 Wedge #23 = 158 lines/mm
  - 2.3.1.2.3 Wedge #24 = 158 lines/mm
- 2.3.2 The masks in all instances cause a distinct loss in resolution, combined with a noticeable loss of sharpness.
- 3. Conclusions
  - 3.1 The increase in illumination with the use of a 400 watt bulb is not appreciable after the illumination uniformity has been adjusted to a reasonable level with a compensating wedge.
  - 3.2 The uniformity compensating wedges have a marked effect on resolution and sharpness.
- 4. Discussion
  - 4.1 The use of such a source in the future will require further tests to ascertain the desirability of a source with an arc beam as large as this one.
  - 4.2 It is conjectured that mirrors should be used to correct illumination fall-off, in the place of carbon wedges.

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Appendix D

The following items have been purchased for trial under  
PAR #7.

1. One Model R.C. Pneumatic Valve Normally Closed

One Model R.C. Pneumatic Valve Normally Open

Summary: These valves were ordered to evaluate their construction and operation. They can be used wherever an automatic valve is required. They will be used on the next application requiring an operator valve. All wetted parts are either PVC or Teflon.

2. One Chemtrol "Alpha" series pump close coupled, 1/3 HP

Summary: This pump was ordered to evaluate the seal construction and other features of the all plastic (PVC) body. It is presently being used on the frame-by-frame breadboard. No trouble has been encountered to date. It will eventually be used for ferricyanide transfer.

3. Standard Microscope Parts

Summary: Parts have been received and are being assembled to fit our needs.

4. One Quantalog Densitometer Model TD 100

Summary: This is a low cost unit suitable for black and white films only. It appears to be quite acceptable for control of field operations where the ultimate in accuracy is not necessary.

Appendix D Cont.-

5. One Pump Allis-Chalmers Close Coupled Model C-1 with 1/2 HP Motor

Summary: Will be used on Production Prototype 70mm frame-by-frame processor. This pump was ordered for checkout against Eastern Industries Model F pumps. The seal construction appears to be superior to that used on the Model F. No operating experience to date.

6. One Log Etronics Image Sharpness Meter

Summary: A sample Model C instrument was used with an inhouse 10-20-40X enlarger. Since the best focus position for each of the three lenses was already established photographically, it was easy to determine whether the Focatron would yield the same lens focus position. With each lens the Focatron quickly indicated a focus position within  $\pm 0.001$  inch from photographic best focus. This was accomplished in the normal blue printing light which is extremely difficult to analyze visually. It appears that a good use for this instrument would be that of quickly obtaining approximate best focus for new precision enlargers which have to be permanently focused during production, and for use in optical systems where the actinic light has a color which prevents visual focusing.

7. Adjusto Speed Drive

Summary: Used on Dalton Processor for main drive.

8. Four Eagle Pneumatic Timers

Summary: These timers will be used to take bounce out of reset on Cycle-flex timers used on secondary developer control

on Trenton Processors.